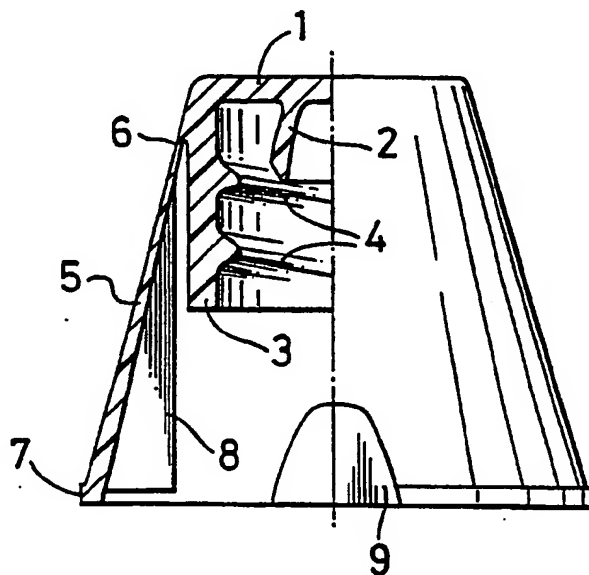




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B65D 55/02	A1	(11) International Publication Number: WO 91/01924 (43) International Publication Date: 21 February 1991 (21.02.91)
(21) International Application Number: PCT/GB90/01174 (22) International Filing Date: 30 July 1990 (30.07.90) (30) Priority data: 8917646.5 2 August 1989 (02.08.89) GB (71) Applicant (for all designated States except US): CMB FOODCAN PLC [GB/GB]; Woodside, Perry Wood Walk, Worcester VR5 1EQ (GB). (72) Inventor; and (75) Inventor/Applicant (for US only) : HOPLEY, Eric, Trevor [GB/GB]; 4 Highland, Caister Lane, Poringland, Nor- wich NR14 7QT (GB). (74) Agent: VOTIER, Sidney, David; Carpmaels & Ransford, 43 Bloomsbury Square, London WC1A 2RA (GB).		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i>

(54) Title: SAFETY CLOSURE**(57) Abstract**

A safety closure for a container has a disc-like top (1), a cylindrical skirt (3) downwardly dependent from the periphery thereof, which skirt is threaded to engage a corresponding thread on the neck of the container, and a substantially frusto-conical skirt (5) provided with internal ribs (8, 18) for engagement with corresponding abutments (10) on the container. The frusto-conical skirt is deformable such that the ribs and abutments do not engage when the skirt is deformed, and has a wall thickness which increases gradually from the point (6) at which it merges into the cylindrical skirt to its outer end (7).

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SAFETY CLOSURE

This invention relates to safety closures and is especially concerned with a safety closure which requires a combined squeezing and turning operation to remove it from a container to which it is applied.

5 Many different types of safety closure, or child-resistant closure, have been proposed, amongst which is the type generally known as the "squeeze-and-turn" type. This has a threaded skirt for screw-threaded application to and removal from the neck of a container, and a deformable portion
10 including one or more internal fins or lugs which co-operate with corresponding abutments on the container neck to resist the unscrewing operation necessary to remove the closure from the container until the deformable portion of the closure is deformed to place the fins or lugs clear of the abutments. A
15 simple form of this type of safety closure is disclosed in United Kingdom Patent Specification 1521201, in which the closure is provided with a single skirt, the upper portion of the skirt being provided with a screw-thread for engagement with a screw-thread on the container neck; and the lower
20 portion of the skirt being deformable and having internal lugs which engage a camming projection on the container neck. When the closure is screwed fully on to the container neck, the lugs on the closure and the camming projection are in engagement and simple unscrewing removal of the closure is
25 impossible. Removal of the closure can only be accomplished if the lugs are placed clear of the projections, and this is accomplished by deforming the lower part of the skirt of the closure by radial pressure applied at right angles to the position of the lugs and projections.

30 A double-skirted or double-walled variation of this type of safety closure is disclosed in United Kingdom Patent Specification No: 1387572. This shows a closure having an inner skirt, which is provided with a screw-thread for engagement with a screw-threaded container neck, and an outer
35 skirt, which is deformable and has projections engaging with complementary recesses on the container neck. Other closures of this general type are disclosed for example in UK Patent

Specifications Nos: 1434546, 1603294 and 2011869.

Both the single-walled and the double-walled safety closure are very efficient, but they do have disadvantages. Thus, in the single-walled safety closure, one part of the closure skirt, the threaded part, must of necessity be substantially non-deformable, whereas the other part of the skirt must be deformable in order that the lugs and projections may be taken out of engagement. This is not a problem with the double-walled closure, since the threaded part may be non-deformable, and the radially outer wall deformable to the extent necessary to remove the lugs from engagement with the projections. However, by its very nature the double-walled closure is unattractive. The presence of the outer wall or skirt, necessarily separated from the inner wall, gives to the closure an overall "heavy" or clumsy appearance.

It is the object of the present invention to provide a safety closure of the general type described above, which does not suffer from the disadvantages of the single-walled closure but yet has a more attractive and pleasing appearance than the known double-walled closures.

According to the invention there is provided a safety closure for a container, said closure having a disc-like top, a cylindrical skirt downwardly dependent from the periphery thereof, which skirt is threaded to engage a corresponding thread on the neck of the container, and a substantially frusto-conical shaped skirt provided with internal ribs for engagement with corresponding abutments on the container, the frusto-conical skirt being deformable such that said ribs and abutments do not engage when said skirt is deformed, wherein the frusto-conical skirt has a wall thickness which increases gradually from the point at which it merges with the cylindrical skirt to its free end.

A structure of this kind has the advantage of an attractive appearance, such as that of the known single-walled closure, combined with the ease of manufacture of the known double-walled closure.

In a preferred embodiment the frusto-conical skirt merges at its upper end into the cylindrical skirt at a position below the periphery of the disc-like top.

The thickness of the wall of the frusto-conical skirt where it merges with the cylindrical skirt may for example be of the order of 0.3 to 0.5 mms, and the thickness of its free end for example 1.0 to 2.0 mms; this represents a taper of some 2° to 5° for a 24mm cap. The cone angle between the frusto-conical skirt and the screw threaded cylindrical skirt is preferably of the order of 5° to 15°, for example 8°.

In one embodiment of the invention the internal ribs on the frusto-conical skirt are radial ribs; alternatively they may lie at an angle to the radius of the cap. In the latter case the abutments on the container may be shaped, e.g. concavely, to receive the leading edges of the ribs.

The thread on the container is suitably provided with a stop buttress to prevent overtightening of the closure onto the container, and also to assist alignment of the closure and container. Alternatively, for the same purpose, the lowermost turn of the thread on the closure may be enlarged, e.g. by enlarging the root internal diameter at this point whilst keeping the thread peak diameter constant, and the thread peak diameter on the container enlarged.

Additional "safety" may be built into the closure by providing it with a tear-off strip or tear band at the lower end of the frusto-conical skirt, such that the deformable skirt cannot be deformed until after the tear band has been removed. Thus, to remove the closure it is first necessary to remove the tear band, then squeeze the deformable skirt to place the ribs and abutments clear of each other, and finally unscrew the closure. The tear band will suitably be joined to the deformable skirt by spaced frangible bridges. In one form the bridges will be positioned axially below the squeeze points of the skirt, with the internal surface of the tear band being tight up against the cylindrical surface of an annular shoulder

formed on the container below the abutments. Squeezing of the skirt to deform it is impossible until the tear band has been removed.

In a second form the internal surface of the tear band
5 is provided with a series of spaced axial ribs, the radially inward surfaces of the ribs being tight up against the annular shoulder on the container to prevent deformation of the skirt on squeezing until after removal of the tear band. The axial ribs may be joined by an
10 annular web for additional stability.

In another form of the closure the internal surface of the tear band is provided with inwardly and obliquely directed teeth or ratchets which mesh with corresponding teeth or ratchets formed on an annular shoulder on the
15 container. In this case, even if it is possible to deform the skirt by squeezing, it is not possible to unscrew the closure until after the tear band has been removed.

In those embodiments of the invention in which the lower end of the frusto-conical skirt is provided with a
20 tear band it may be of advantage to provide yet further "safety" by the provision of an upstanding annular collar which surrounds the lower portion of the frusto-conical skirt and prevents access to the squeeze points on the skirt. The annular collar may be formed as an extension
25 of the tear band and may, if desired, be stiffened at least in the region of the squeeze points by buttresses or stiffening ribs. The stiffening ribs on the collar may suitably be formed as extensions of the axial ribs provided on the inside of the tear band in accordance with
30 the embodiment detailed above.

In a still further embodiment of the invention, a security ring is provided at the lower end of the frusto-conical skirt, and joined thereto by a frangible web or spaced frangible bridges. The inner wall or surface of
35 the security ring is provided with one or more inwardly-directed projections which act against a surface of the container such that when the closure is unscrewed from the container the web or bridges fracture and the security

ring remains on the container. The inwardly-directed projections are preferably upwardly-directed spaced arcuate fins which, on unscrewing of the closure, come into contact with an annular shoulder on the container and prevent further upwards movement of the security ring relative to the container neck. In such an embodiment as this, the security ring is preferably attached to the frusto-conical skirt by means of four equi-spaced frangible bridges, suitably positioned at the nodal points of the cap skirt (i.e. those points which do not move out of position when the frusto-conical skirt is deformed). The upwardly- and inwardly-directed fins are preferably four in number, and situated between adjacent pairs of bridges.

The fins may be moulded in the closure in the attitude which they assume when the closure is attached to the container. Alternatively they may be moulded as inwardly- and downwardly-projecting fins which are then caused to flex and pivot about their junction with the security ring in a post-moulding operation so that they assume an inwardly- and upwardly-directed attitude. This post-moulding operation can be performed as the closure is screwed onto the container.

The accompanying drawings illustrate a number of possible forms of safety closure according to the invention. In the drawings,

Figure 1 is a part sectional elevation of a safety closure according to one embodiment;

Figure 2 is a detail of a second embodiment, having a tear band, attached to a container;.

Figure 3 is an elevation, partly in section, of a further embodiment having an alternative form of tear band;

Figure 4 is a section on the line IV-IV of Figure 3;

Figure 5 is a part sectional elevation of a fourth embodiment of the invention;

Figure 6 is a section on the line VI-VI of Figure 5;

Figure 7 is a part sectional elevation of a fifth

embodiment of the invention; and

Figure 8 is a part-sectional elevation of a sixth embodiment of the invention.

The safety closure shown in Figure 1 has a disc-like
5 top 1 from which depends an internal flexible annular
sealing plug 2. From the periphery of the disc-like top 1
depends a substantially rigid cylindrical inner wall 3
having a screw thread 4 for engagement with a
complementary thread on the neck of a container to which
10 the closure is applied.

A frusto-conical outer wall 5 merges into the
cylindrical wall 3 a short distance below the top of the
wall 3. The wall 5 tapers in thickness, its thinnest
portion being at the point 6 where it merges into the
15 cylindrical wall 3, and its thickest portion being at its
outer end 7. The thinning of the wall 5 where it merges
into the wall 3 gives the necessary flexibility or de-
formability to the wall 5.

Formed internally of the wall 5 are ribs 8 which
20 engage and co-operate with corresponding abutments or
projections on the container neck in the manner disclosed
in the prior Specifications referred to above. Thus, as
the closure is screwed onto the container neck, the ribs 8
ride over and seat behind the corresponding abutments on
25 the neck, so that normal unscrewing removal of the closure
is impossible. In order to unscrew the closure, the ribs
8 must be placed clear of the abutments, and this is
achieved by exerting radial pressure on the wall 5, at the
positions of diametrically opposed flats 9 provided at
30 right angles to the ribs 8, and this has the effect of
deforming the wall 5, at its lower end, into elliptical
form whereby the ribs 8 are placed clear of the abutments
on the container neck and the closure may then be un-
screwed in the normal manner.

35 In the embodiment shown in Figure 2, the internal ribs
on the frusto-conical skirt 5 are not radial (as at 8 in
Figure 1) but are rather obliquely directed ribs 18 which
bear against abutments 10 formed on the neck portion 11 of

a container. There are suitably two such abutments 10, diametrically opposed. Situated beneath abutments 10 is an annular shoulder 12 having a cylindrical outer surface 13. Attached to the end of skirt 5 is a tear band 14.

- 5 The attachment of band 14 to skirt 5 is through spaced frangible bridges 15. Preferably there is a bridge adjacent each squeeze point or flat 9.

The inner surface of the band 14 is a tight, or at least snug, fit against the cylindrical surface 13 of the annular shoulder 12. Thus, it is impossible to squeeze the skirt 5 at the squeeze points 9 while the tear band 14 is attached to the skirt 5. Removal of the tear band must precede the deformation and subsequent unscrewing of the closure.

- 15 In the embodiment of Figures 3 and 4 the internal ribs 18 are again obliquely directed, as in the Figure 2 embodiment. The abutments 10 on the container (one only is shown) are profiled to receive the edges of the ribs 18. Beneath the abutments 10 is an annular shoulder 20 provided with opposed sets of ratchets 21.

Attached to the lower end of skirt 5 is a tear band 24, the attachment of the tear band to the skirt being through spaced frangible bridges 25. Provided internally of the tear band are opposed series of ratchets 26 which mesh as shown with the ratchets 21 on the container neck, thus preventing unscrewing of the closure until the tear band 24 has been removed. The ends of the tear band are joined by a thin link band 27 through a frangible bridge 28.

- 30 The closures of Figure 2 and Figures 3 and 4 are applied to a container by simply screwing them on in the normal way. As the closures approach their fully-tightened position, the ribs 18 ride over the abutments 10, and in the case of the Figures 3 and 4 embodiment the ratchets 26 on band 24 ride over the ratchets 21. Normal unscrewing of the closures is then impossible, since abutment of ribs 18 and ratchets 26 with abutments 10 and ratchets 21 respectively prevent unscrewing rotation of

the closures. Further, in neither case can the skirts 5 be squeezed to deform them so as to place the abutting features clear of each other.

Indeed, the application of pressure at squeeze points 9 only serves to increase the engagement of the ratchets in the Figures 3 and 4 embodiment. The tear bands 14, 24 must be removed before the skirts 5 can be deformed and the closures removed from their respective containers.

The embodiment of Figures 5 and 6 and that of Figure 7 are similar to that shown in Figure 2. In the former cases, however, the tear band 14 is radially spaced from the external cylindrical surface of the shoulder 12, but is provided with spaced axial ribs 30 in the region of the squeeze points 9 (only one set is shown, for convenience). The tear band is attached to the skirt 5 by bridges 31 adjacent the ribs 30 and by spaced bridges 32 elsewhere. The interior axial surfaces of the ribs 30 are a tight, or at least snug, fit against the external cylindrical face of the shoulder 12. The provision of an integrally-formed arcuate web 33, at least in the region of the ribs 30, helps to ensure that when the closure is squeezed at diametrically-opposed points 9, the abutment of the ribs 30 against the shoulder 12 prevents the skirt 5 from being deformed.

In the form of the invention illustrated in Figure 7, which is otherwise identical to that of Figures 5 and 6, a further safety feature is provided by the upstanding annular collar 40 which surrounds the lower half of skirt 5 and prevents finger access to the squeeze points 9. The collar 40 is an axial extension of tear band 14 and, in the embodiment shown, is provided with internal strengthening ribs 41 which conveniently are axially aligned with ribs 30.

The example of the invention illustrated in Figure 8 is similar in many respects to that shown in Figure 5, but in the case of the Figure 8 example a security ring 50 is attached to the lower end of skirt 5 by means of four equi-spaced frangible bridges 51, the points of attachment

of the bridges 51 to skirt 5 being at the nodal points of the skirt. Integrally moulded to the security ring 50 are four arc-shaped flexible fins 52, equi-spaced around the ring 50 and situated between respective pairs of bridges 51 when the ring 50 is viewed in plan. Fins 52 have their roots at the lower end of ring 50, from where they extend upwardly and inwardly. An annular shoulder 53 is provided on the container beneath the screw-threaded neck 11.

The closure is removed by squeezing the skirt 5 at the squeeze points 9, whereby the ribs 18 are placed radially clear of the abutments 10. The closure may then be unscrewed until the free ends of the fins 52 come into contact with the lower face of the shoulder 53. This arrests the upwards movement of security ring 50. Continued unscrewing of the closure stresses the bridges 51 until they break, allowing complete removal of the closure while the ring 50 remains on the container.

The diameter of the circle produced by the upper ends of the fins 52 is preferably slightly larger, e.g. by about 2 mm, than the external diameter of the nearest portion 54 of the container, so ensuring that the ring 50 falls down the container and is not retained in its Figure 8 position by frictional engagement with the container.

All the closures illustrated are suitably produced by the injection moulding of a thermoplastics material such as, for example, polypropylene or polystyrene.

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CLAIMS

1. A safety closure for a container, said closure having a disc-like top (1), a cylindrical skirt (3) downwardly dependent from the periphery thereof, which skirt is threaded to engage a corresponding thread on the neck of the container, and a substantially frusto-conically shaped skirt (5) provided with internal ribs (8,18) for engagement with corresponding abutments (10) on the container, the frusto-conical skirt being deformable such that said ribs and abutments do not engage when said skirt is deformed, wherein the frusto-conical skirt has a wall thickness which increases gradually from the point (6) at which it merges into the cylindrical skirt to its outer end (7).
2. A safety closure according to claim 1 wherein the frusto-conical skirt merges at its upper end into the cylindrical skirt at a position below the periphery of the disc-like top.
3. A safety closure as claimed in claim 1 or 2 in which a tear band (14,24) is provided at the lower end of the frusto-conical skirt (5), removal of the tear band being necessary before the skirt can be deformed.
4. A safety closure as claimed in claim 3 wherein the inside surface of the tear band comprises a series of spaced axial ribs (30) the radially inward surfaces of which are a tight fit against an annular shoulder (12) on the container.
5. A safety closure as claimed in claim 4 wherein the axial ribs are connected by an arcuate membrane.
6. A safety closure as claimed in claim 3 wherein the internal surface of the tear band is provided with inwardly and obliquely directed teeth or ratchets (26) which mesh with corresponding teeth or ratchets (21) formed on an annular shoulder on the container.
7. A safety closure as claimed in any of claims 1 to 6 wherein the lower portion of the frusto-conical skirt is surrounded by an annular collar (40).
8. A safety closure as claimed in claim 7 wherein the

annular collar is an axial extension of the tear band of any of claims 3 to 6.

9. A safety closure as claimed in claim 1 or 2 wherein a security ring (50) is provided at the lower end of the
5 frusto-conical skirt (5), and joined thereto by a frangible web or spaced frangible bridges (51), the inner wall of the security ring being provided with one or more inwardly-directed projections (52) which act against a
10 unscrewed from the container the web or bridges (51) fracture and the security ring (50) remains on the container.

10. A safety closure as claimed in claim 9 wherein the inwardly-directed projections are upwardly- and inwardly-
15 directed spaced fins (52) which act against an annular shoulder on the container.

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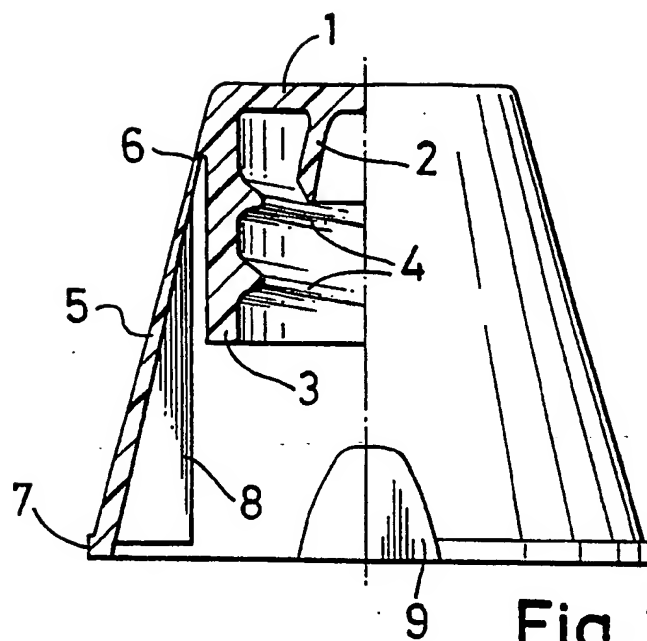


Fig. 1

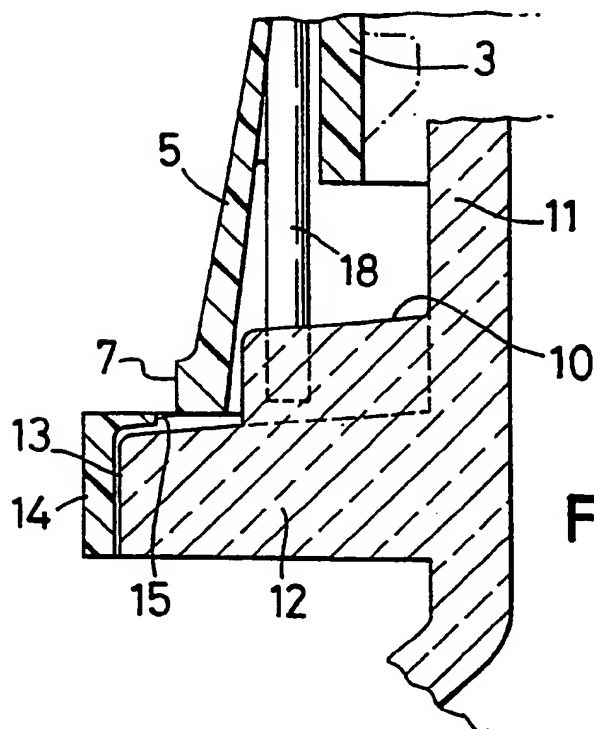


Fig. 2

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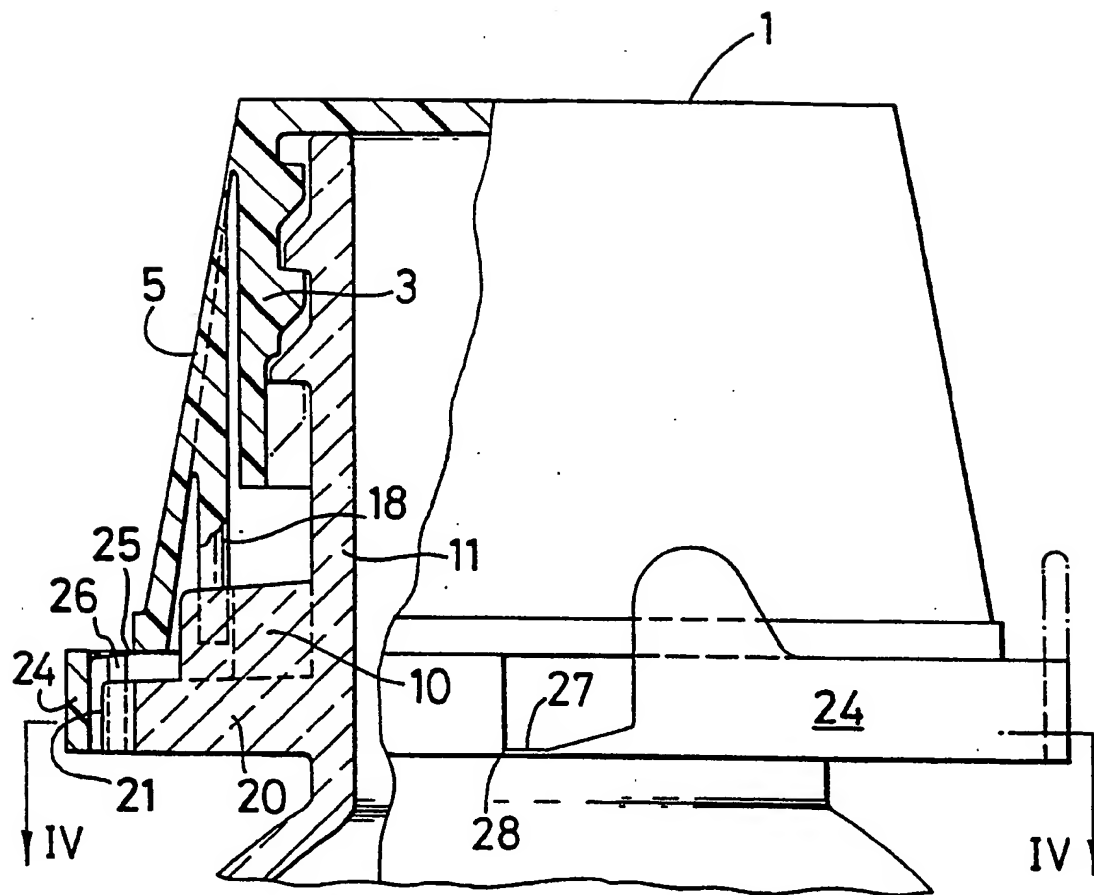


Fig. 3

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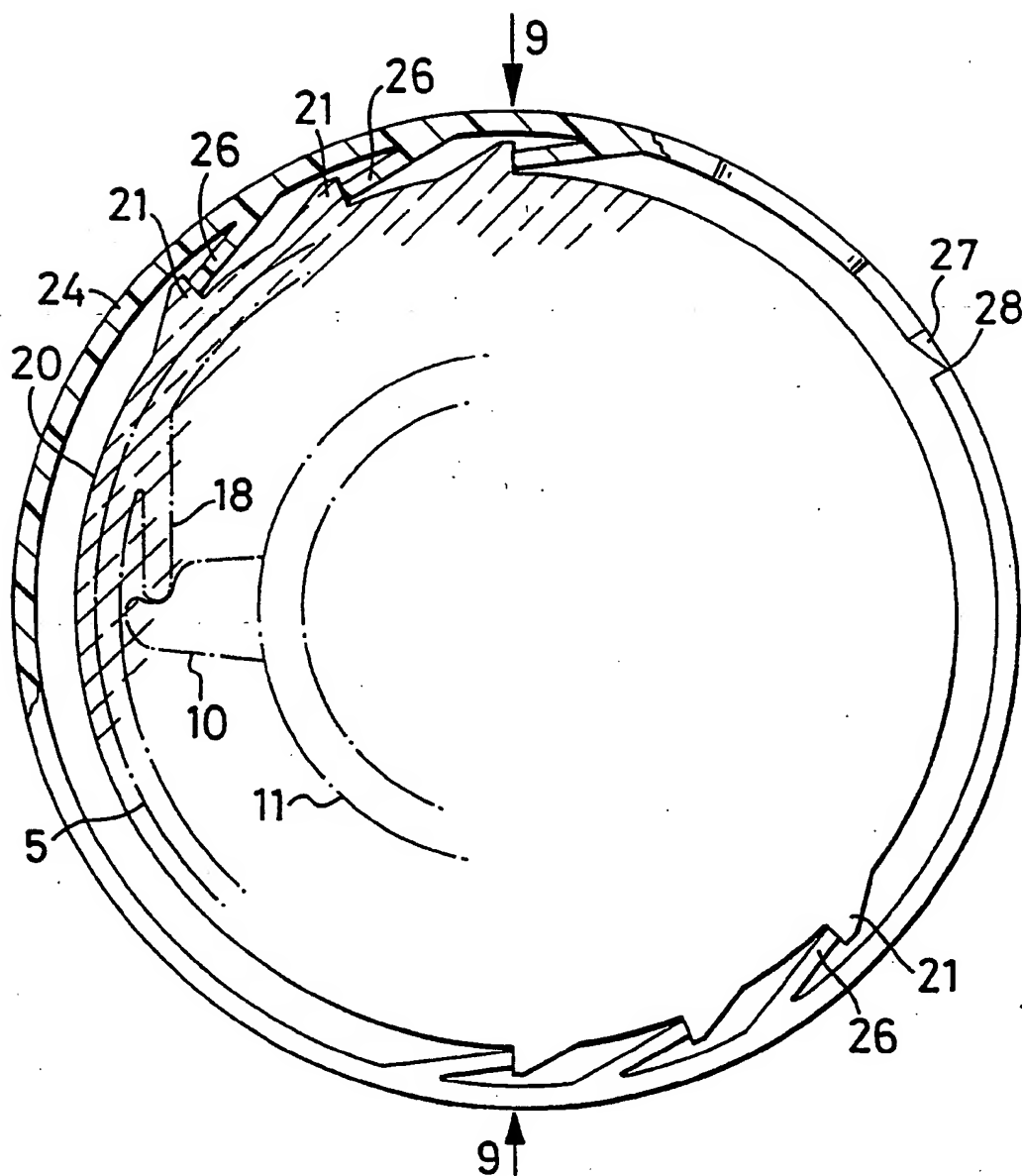
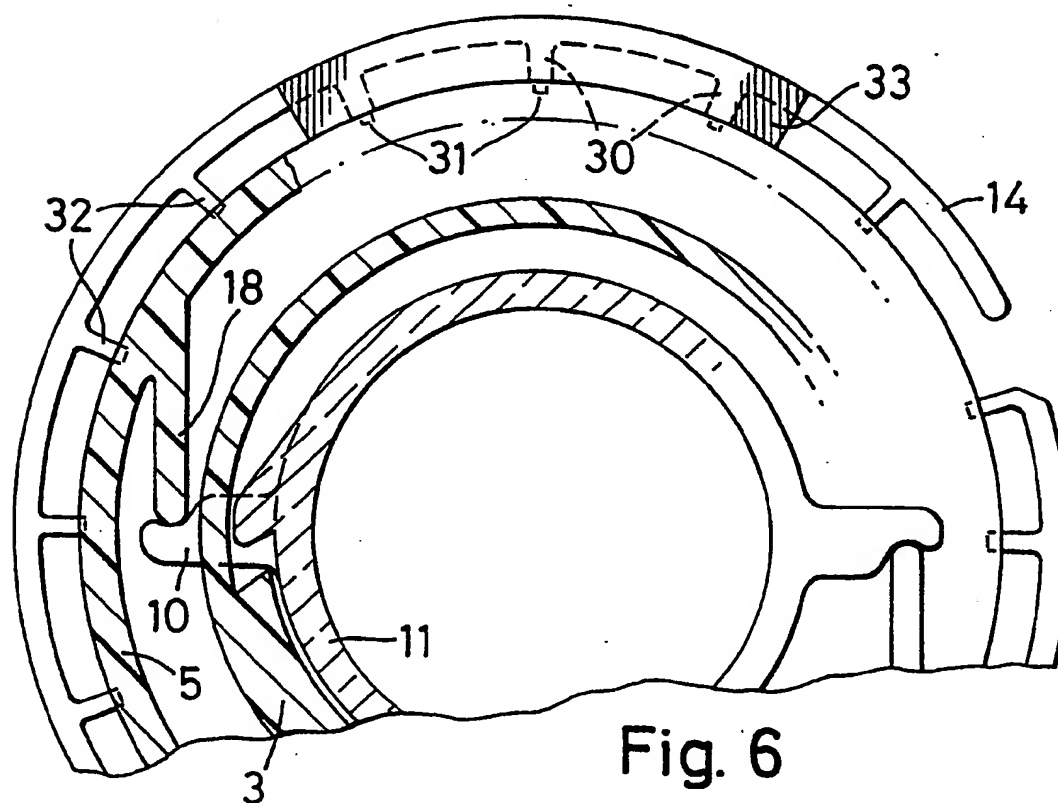
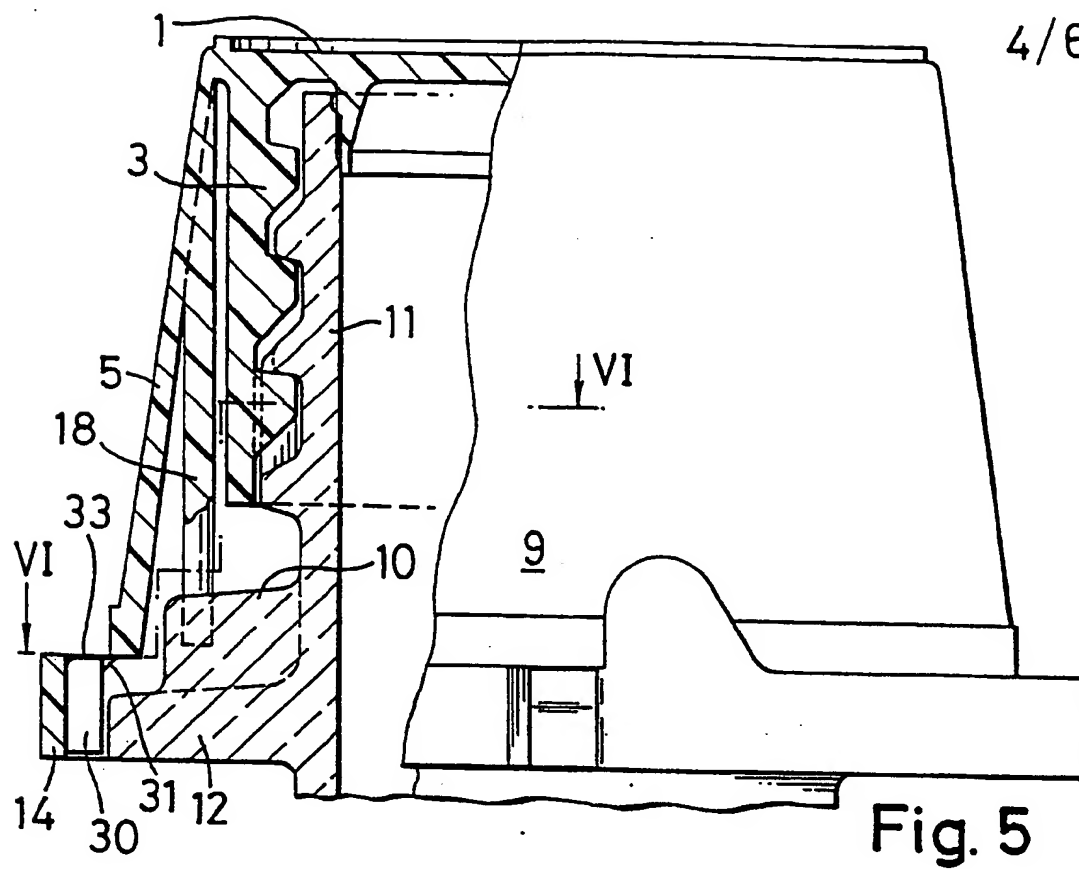


Fig. 4



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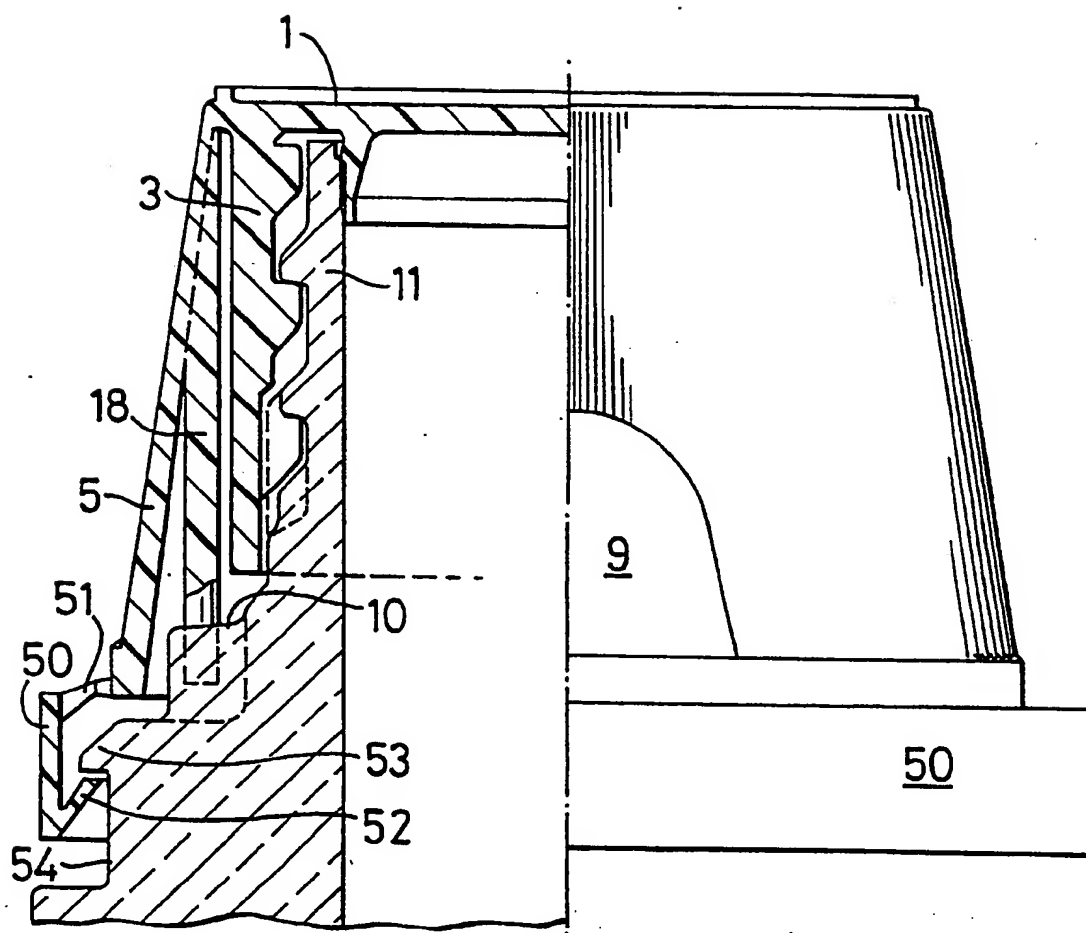


Fig. 8

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/01174

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : B 65 D 55/02																				
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; border-bottom: 1px solid black; padding: 5px;">Classification System</td> <td style="border-bottom: 1px solid black; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">IPC⁵</td> <td style="padding: 5px;">B 65 D</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	IPC ⁵	B 65 D														
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black; padding: 5px;">Category ⁹</th> <th style="width: 70%; border-bottom: 1px solid black; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">FR, A, 2467791 (FARGES) 30 April 1981 see the whole document</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">3,6-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4117945 (MUMFORD) 3 October 1978 see column 5, line 47 - column 6, line 22; column 7, lines 40-58; figures 1,16 (cited in the application)</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">FR, A, 2571695 (JARRY) 18 April 1986 see the whole document</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3,6,8-10</td> </tr> <tr> <td></td> <td style="text-align: center; vertical-align: top; padding: 5px;">-- ./. </td> <td></td> </tr> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	FR, A, 2467791 (FARGES) 30 April 1981 see the whole document	1-2	Y	--	3,6-10	Y	US, A, 4117945 (MUMFORD) 3 October 1978 see column 5, line 47 - column 6, line 22; column 7, lines 40-58; figures 1,16 (cited in the application)	1-2	Y	FR, A, 2571695 (JARRY) 18 April 1986 see the whole document	1-3,6,8-10		-- ./.	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>																				
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px;">19th September 1990</td> <td style="text-align: center; padding: 5px;">- 9. 10. 90</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">EUROPEAN PATENT OFFICE</td> <td style="padding: 5px;"> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> </div> <div style="border: 1px solid black; padding: 2px 5px;">M. PEIS</div> </div> </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	19th September 1990	- 9. 10. 90	International Searching Authority	Signature of Authorized Officer	EUROPEAN PATENT OFFICE	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> </div> <div style="border: 1px solid black; padding: 2px 5px;">M. PEIS</div> </div>										
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	EP, A, 0202728 (PHOENIX CLOSURE, INC.) 26 November 1986 see abstract --	6
Y	GB, A, 2148259 (ANCHOR HOCKING) 30 May 1985 see page 2, lines 30-59; figure 5 --	7-8
Y	EP, A, 0307169 (KERR GLASS) 15 March 1989 see abstract -----	10

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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 2467791	30-04-81	None	
US-A- 4117945	03-10-78	AU-B- 509720	22-05-80
		AU-A- 3709978	20-12-79
		CA-A- 1122572	27-04-82
		DE-A, C 2828063	11-01-79
		GB-A- 1603294	25-11-81
FR-A- 2571695	18-04-86	FR-A- 2600628	31-12-87
EP-A- 0202728	26-11-86	US-A- 4609115	02-09-86
		AU-B- 577015	08-09-88
		AU-A- 5731686	20-11-86
GB-A- 2148259	30-05-85	None	
EP-A- 0307169	15-03-89	US-A- 4807771	28-02-89

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